

R228/407

DUBLIN INSTITUTE OF TECHNOLOGY  
KEVIN STREET, DUBLIN 8.

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# **BSc Computer Science**

**Year 4**

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**SUPPLEMENTAL EXAMINATIONS 2008**

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## **KNOWLEDGE BASED SYSTEMS II**

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2 HOURS

ATTEMPT **3** QUESTIONS

ALL QUESTIONS CARRY EQUAL MARKS

1. (a) Provide a definition for the term *design pattern* and discuss the strengths of a pattern-oriented approach to software development. In your answer you should identify and describe the various attributes which are used to describe a design pattern.

**(10 marks)**

- (b) Each of the FIPA interaction protocols could be seen as a pattern to aid designers in the selection of an appropriate method of interaction in a given multi-agent system. Considering this, provide a pattern definition for two interaction protocols for conducting auctions in a multi-agent system.

**(11 marks)**

- (c) Consider the following situation:

*A set of agents are required to communicate with each other and interact to determine whether to admit a new agent into their system. Some agents in the system may already have a relationship with the new agent, whereas others may not.*

Provide an interaction protocol which can be used to resolve this situation. State any assumptions you make, and comment on the strengths and weaknesses of your protocol.

**(12 marks)**

2. (a) Explain clearly what is meant by *speech act theory*, and describe the relationship between this and agent communication languages such as FIPA ACL and KQML. Compare and contrast each of these two agent communication languages according to the support they provide for agent communication.

**(8 marks)**

- (b) Describe the association between *platforms, containers, agent management services, directory facilitators, agents and behaviours* in the *Java Agent Development Environment (JADE)*.

**(10 marks)**

- (c) Present your opinion on the strengths and weaknesses of the agent-oriented approach to software engineering. Support your opinion with appropriate references.

**(15 marks)**

3. Consider the following problem:

*A flight management system requires that users can perform searches for fares according to the dates, times, prices and airports. Airlines are able to update flight information and provide up to date information and changes. Users are able to view previous bookings and be alerted about price changes and special rates. A full history is maintained for frequent flyer mile calculation. Updates can be sent to mobile phones and/or email addresses.*

Provide a high level design for this system using the *Prometheus* methodology. State any assumptions you make.

Marks will be allocated as follows:

- (a) System Specification **(18 marks)**
  
  - (b) Architectural Design **(15 marks)**
4. (a) Illustrate the operation of the Q-Learning algorithm for reinforcement learning. **(8 marks)**
- (b) Clearly distinguish between a *society of mind* and a *multi-agent system* and discuss the challenges attached to the development of each. **(10 marks)**
- (c) Describe three methods for performing action selection based on actions propagated by agents and weighted according to their calculated reinforcement learning values.

Frame each method as a pattern, illustrating, among other things the contexts in which they are most appropriate, and the contexts in which they serve no function. **(15 marks)**